

**MPM2D**  
**Examination**  
**Exam B, 2013**  
**Length: 3 hours**  
(Exam set for 2 hrs. + 1 hr. flex time)



Name : \_\_\_\_\_

Teacher : \_\_\_\_\_

School : \_\_\_\_\_

**Instructions to students:**

1. This examination booklet is **12 pages** long.  
Please check that you have all the pages.
2. Answer all questions with complete solutions in the spaces  
provided on the examination paper.
3. You may use any school-approved calculator on this  
examination.  
Make sure that your calculator is in **DEGREE** mode.  
Do **not** share your calculator.
4. There is a formula sheet that goes with the examination.
5. Diagrams are not drawn to scale.

## MPM2D EXAM KEY WORDS

Key words are used throughout the exam so you know how to answer different types of questions. The key words are explained below.

**Compare:** Tell what is the same and what is different

**Describe:** Use words to create a mental picture for the reader, including all the relevant characteristics or qualities

**Determine:** Use mathematics to find a solution to the problem

**Explain:** Use words, symbols and diagrams to make your solution clear

**Identify:** State the number, property, etc.

**Justify:** Give reasons and mathematical evidence to show your answer is correct

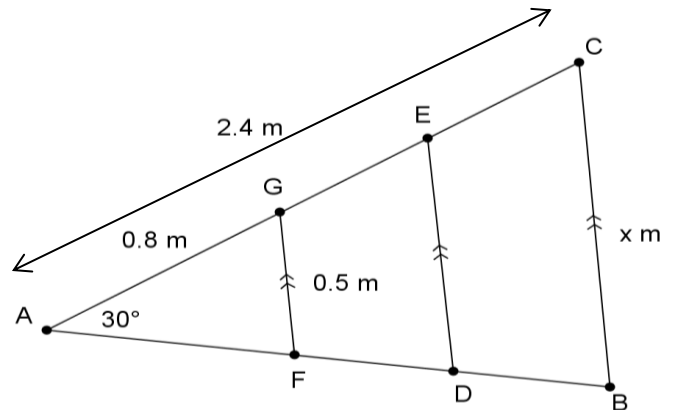
**Solve:** Determine the value(s) of a variable that make an equation true

**State:** Write only the answer

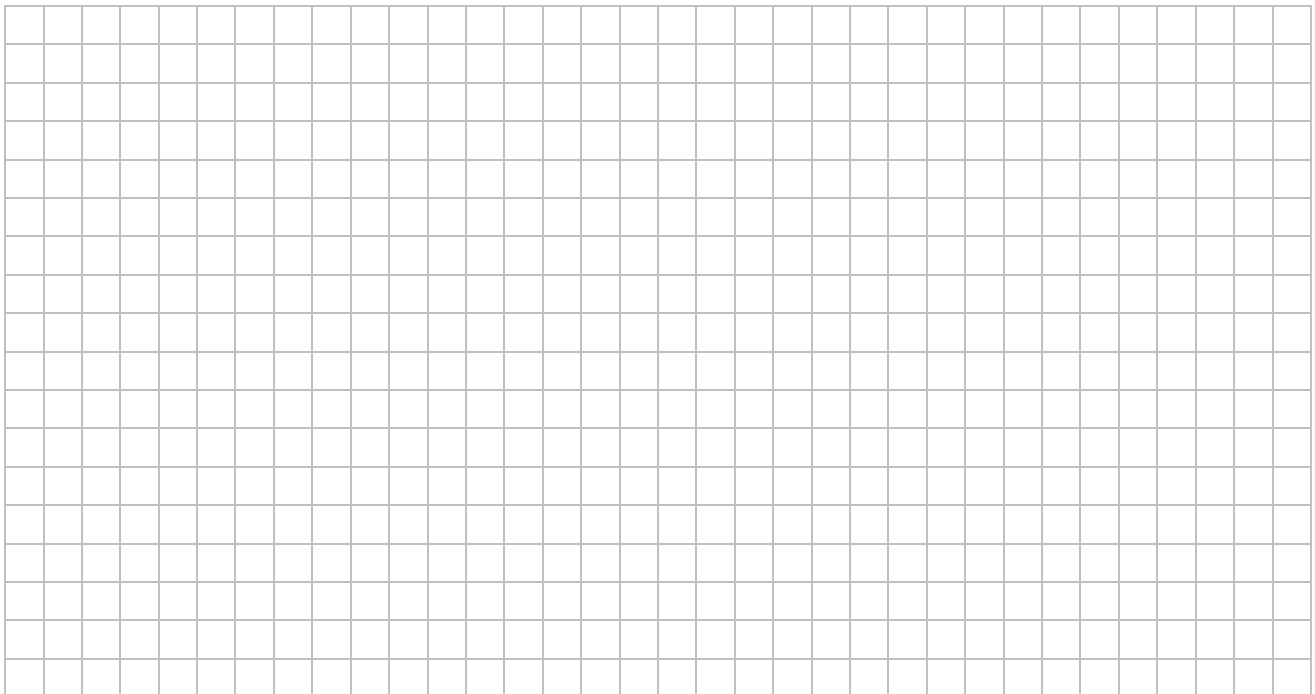
**Verify:** Formally demonstrate the validity of a solution or a given property

**A) Trigonometry**

- A1) Roof trusses are being constructed as shown in the diagram. **Determine** the value of  $x$ .



- A2) Two boats leave a harbour at the same time in directions that are  $20^\circ$  apart. If one is travelling at 20 km/h and the other at 30 km/h, how far apart are they after two hours?



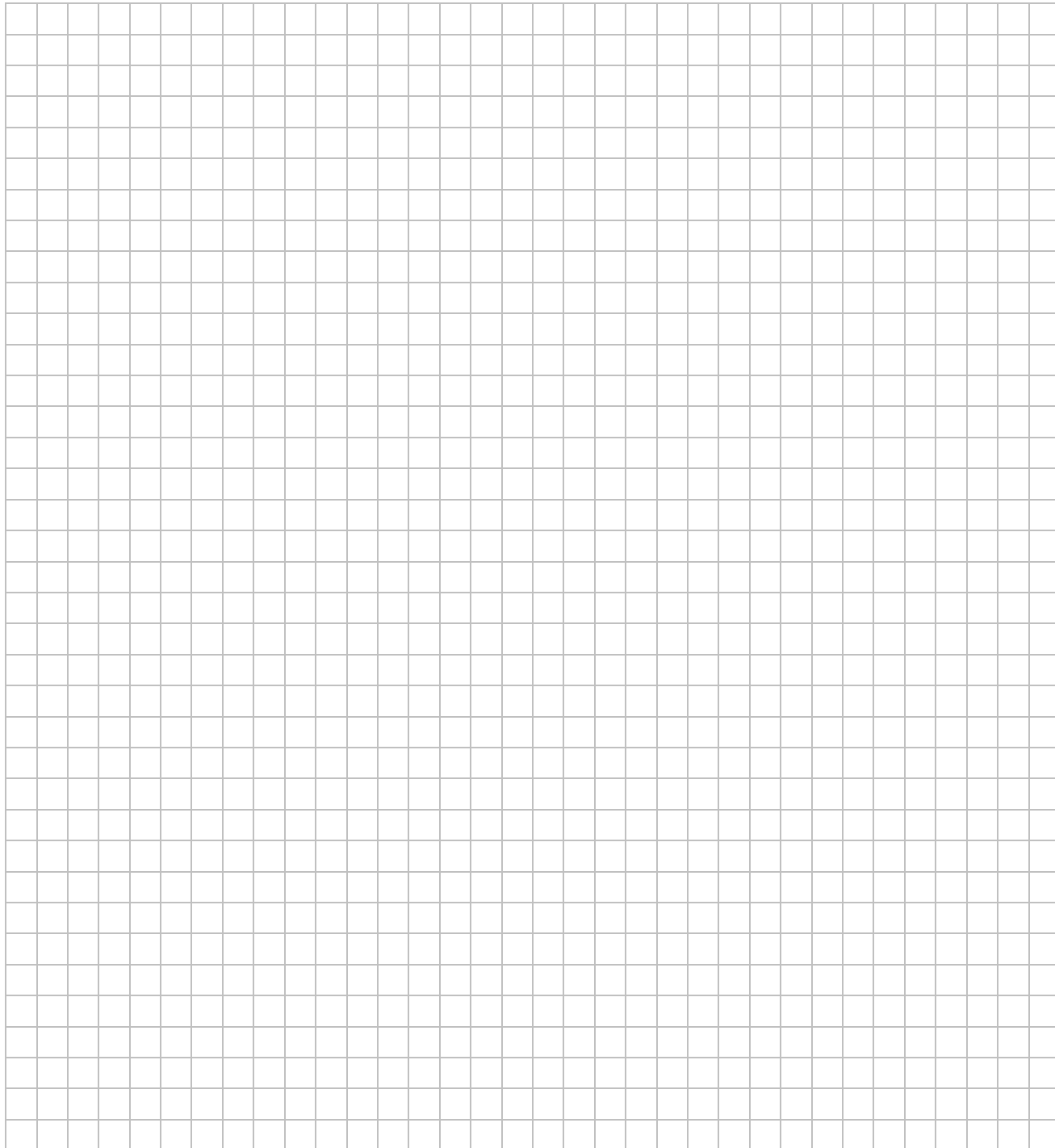
- A3) A ladder must reach 6 metres up a wall and pass over a fence. The fence is 1.5 metres in height and 3 metres from the wall. **Determine** the length of the ladder.



- A4)** From a window in an office building, two cars which are 20 metres apart are seen in the same direction, one at an angle of depression of  $25^\circ$  and the other at an angle of depression of  $50^\circ$ .

Your friend thinks that since one angle is half of the other, one car must be twice as far away from the base of the building as the other.

Do you think this is true? **Justify** your answer.



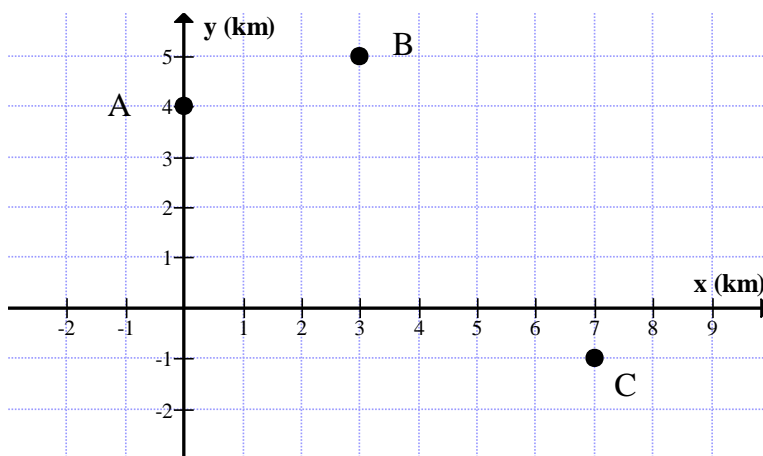
## **B) Analytic Geometry**

- B1)** A sample of two white bricks and five red bricks has a total mass of 31.4 kg.  
A sample of four white bricks and one red brick has a total mass of 17.8 kg.  
**Determine** the mass of each colour of brick.



- B2)** Ahmed, Bonnie and Clyde are located at  $A(0, 4)$ ,  $B(3, 5)$  and  $C(7, -1)$  respectively. They agree to meet at their truck located halfway between Bonnie and Clyde.  
**Determine** the distance Ahmed must travel to reach the truck.

Note: each unit on the grid represents 1 km.



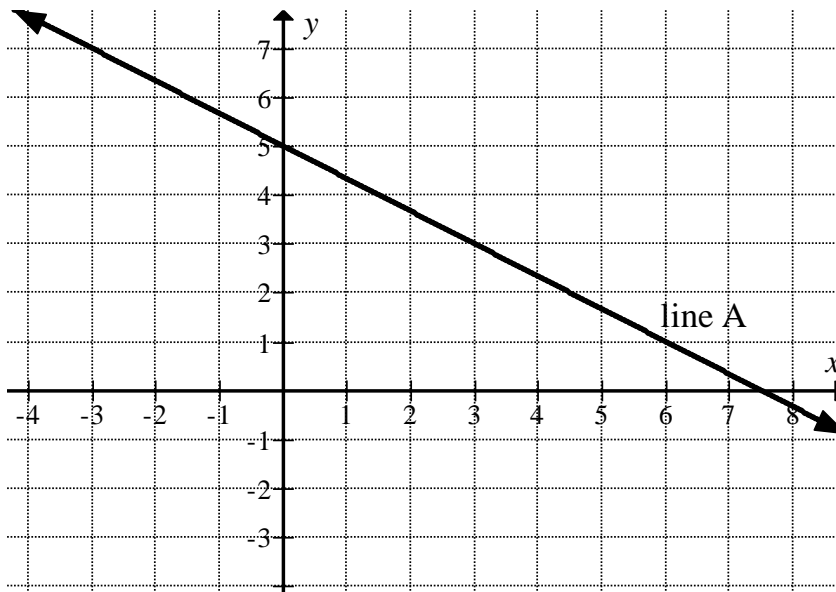
**B3)** The graph below is one relation in a linear system.

- a) **Determine** an equation of another linear relation that creates a system with no solution.

**Justify** your choice.

- b) **Determine** other linear relations that create systems with different numbers of solutions.

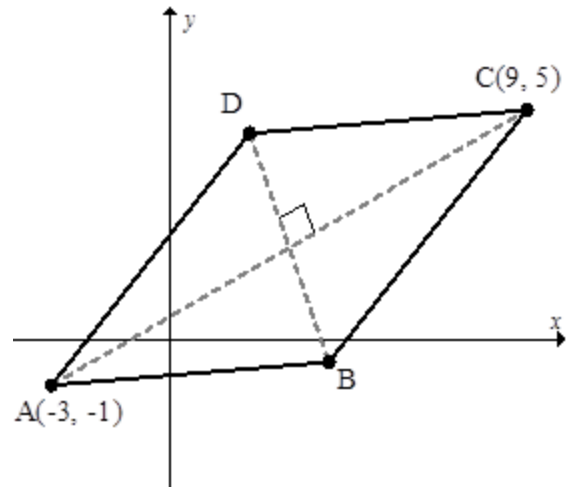
**Justify** your choices using multiple representations.



**B4)** The diagonals of any rhombus are perpendicular bisectors of each other. Line segments AC and BD are diagonals of rhombus ABCD.

a) **Determine** possible coordinates for B and D.

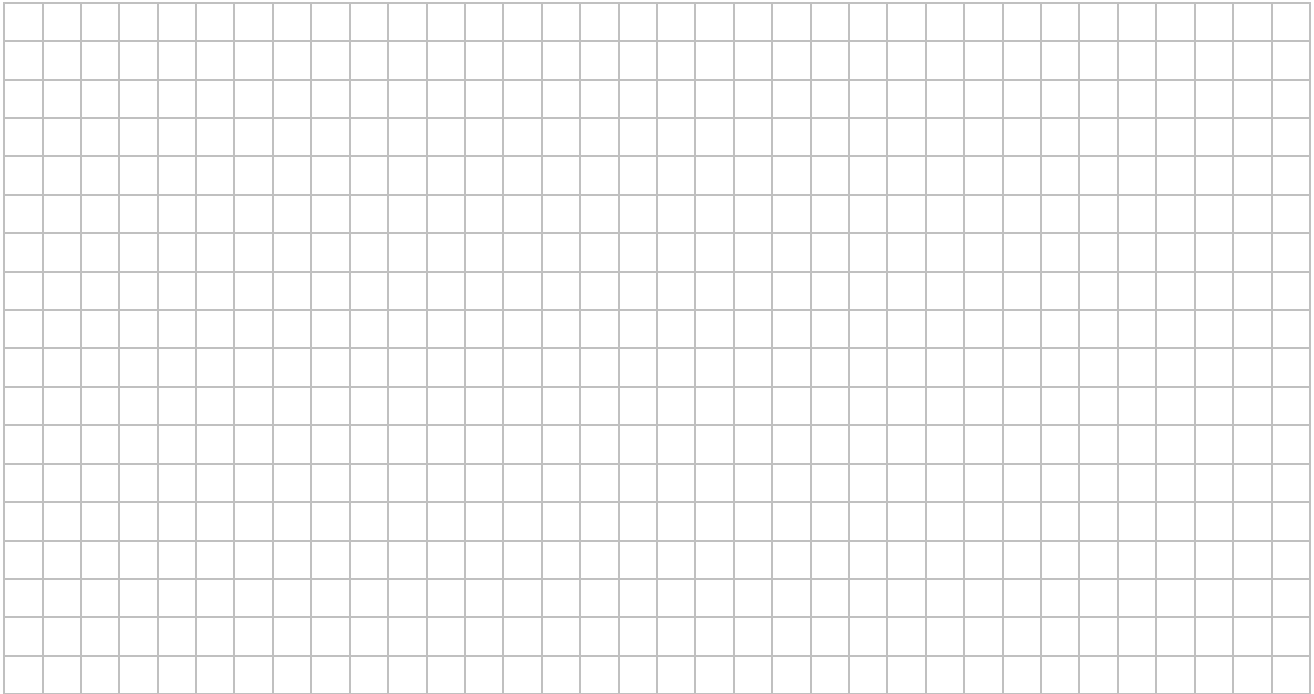
b) Are there other possible locations for B and D? **Explain.**



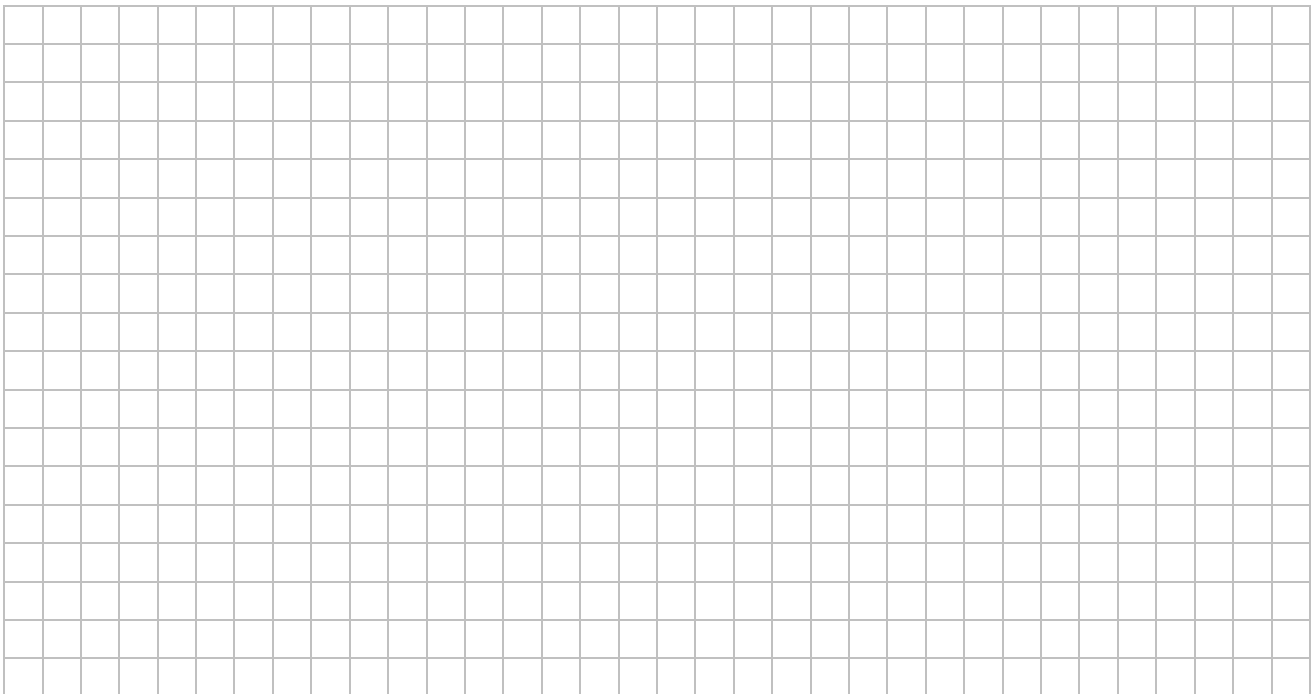


### C) Quadratic Relations

C1) **Determine** the key features of the parabola with equation  $y = x^2 + 2x - 8$ .



C2) **Determine** the equation of a quadratic relation with an axis of symmetry of  $x = 4$  and an  $x$ -intercept at  $-1$ .



- C3)** The table below shows some data for the average number of hours of sleep per week, by age.

Age	Average number of hours of sleep per week
15	72
16	58
17	48
18	42
19	40
20	42

- Determine** an equation which could be used to predict the average number of hours of sleep per week for other ages, based on the data in the table.
- Could this model be used to predict the average number of hours of sleep per week for all ages? **Explain.**

A full-page sheet of white graph paper featuring a uniform grid of thin, light gray horizontal and vertical lines. The grid consists of small squares covering the entire area of the page.

- C4)** A stream of water flowing out of a hose can be modelled by the equation  $y = -\frac{1}{6}(x+1)(x-11)$ , where  $y$  is the height of the water, in metres above the ground, and  $x$  is the horizontal distance from the hose, in metres.

The fireman climbs up the inclined ladder so that the peak of the stream is now 4 metres further horizontally and 2 metres higher.

How far can the water stream now reach?

